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EPA Region 8

Screening Plant Removal Action Work Plan

Libby, Montana Asbestos Emergency Response Project

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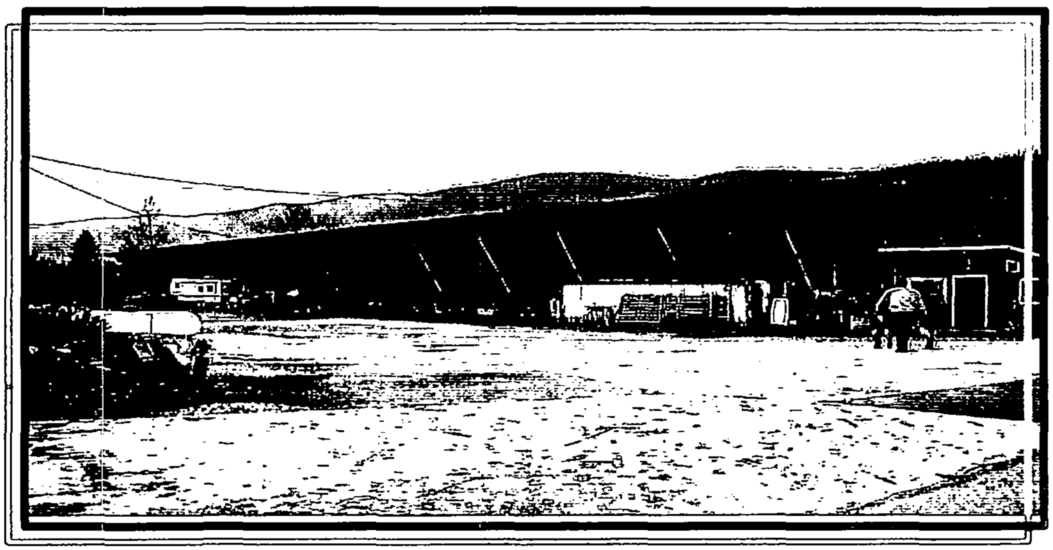

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Section 1
Introduction

1.1 Project Understanding

The Environmental Engineering Division (DTS-33) of the John A. Volpe National Transportation Systems Center (Volpe Center) is providing environmental engineering and contaminant removal support to Region 8 of the U.S. Environmental Protection Agency (EPA). The Volpe Center and their contractor, CDM Federal Programs Corporation (CDM) and it's subcontractor, Pacific Environmental Services, Inc. (PES), along with the Volpe Center's removal/demolition contractor, MARCOR Remediation, Inc. (MARCOR), have been requested to prepare a Removal Action Work Plan (RAWP), and Remedial Action Cost Estimate for the Libby Asbestos Project in Libby, Montana. The Volpe Center is functioning as coordinator of this effort, consolidating information provided by CDM, PES and MARCOR.

The Libby Asbestos Project includes time critical removal actions at two locations of the Libby Asbestos Site (the Site) located in Montana, within Sections 3 and 10, T.30N., R.31W. of the Libby Quadrangle, in the county of Lincoln; the Export Plant (herein referred to as Operable Unit 01) and the Screening Plant (herein referred to as Operable Unit 02). This RAWP is for removal of asbestos contamination, building demolitions, and contaminated soil removal at Operable Unit 02. Operable Unit 02 is located at the base of the abandoned vermiculite mine. It is our understanding that EPA has designated the work at the Operable Unit 02 as a fund-lead.

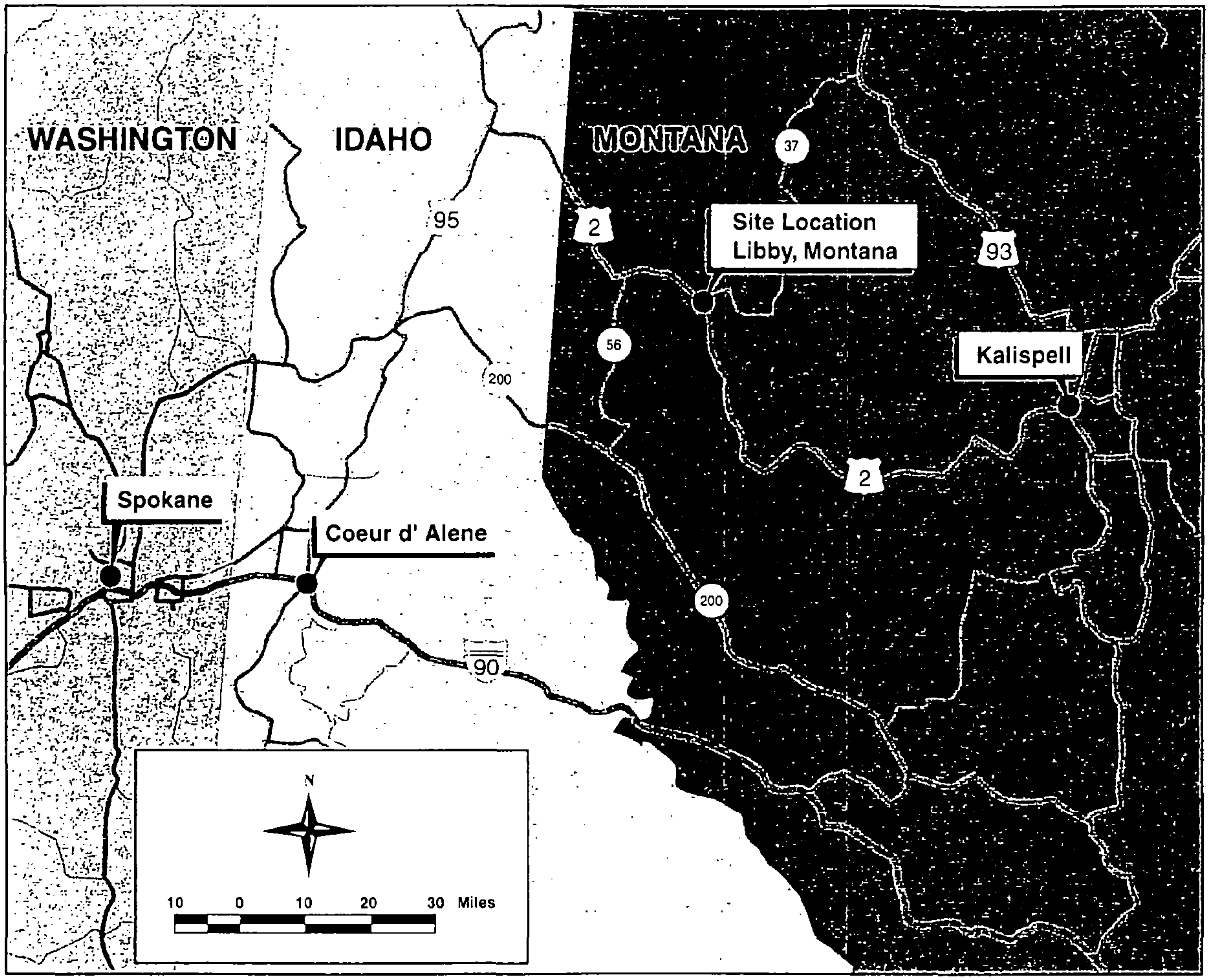
As a first step toward completing a RAWP for Operable Unit 02, a walkover was conducted on April 11-12, 2000. Following is a summary of the walkover and supplemental, relevant information obtained since then.

1.2 Background Information for the Operable Unit 02

Information included in this section was obtained during the walkover and subsequently from copies of excerpts from an assessor's report prepared for the owners of the Operable Unit 02. Figure 1-1 provides the general locus plan of Operable Unit 02 and the abandoned vermiculite mine. Figure 1-2 provides the location of Operable Unit 02 and the abandoned vermiculite mine on the USGS Quadrangle.

1.2.1 Current Usage

Operable Unit 02 is currently operated primarily as a nursery and related product sales, storage for nursery and related supplies, and leased storage for recreational vehicles, boats, automobiles, and other items. Photographs of Operable Unit 02 taken during the walkover are provided in Appendix A.



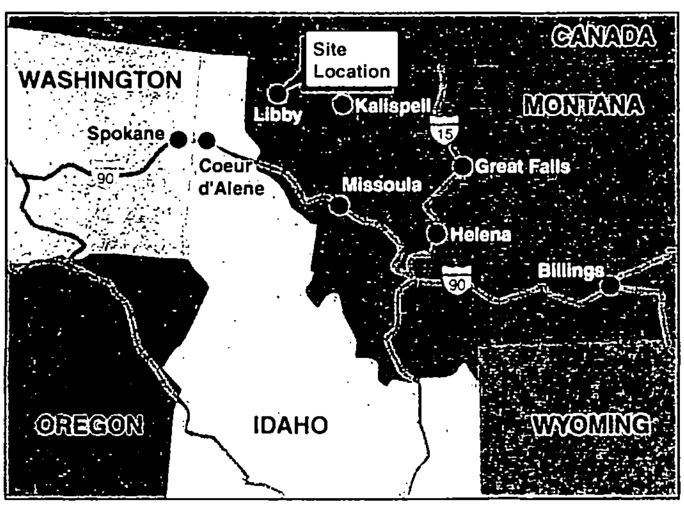


Figure 1-1
Site Locus Plan
Libby, Montana

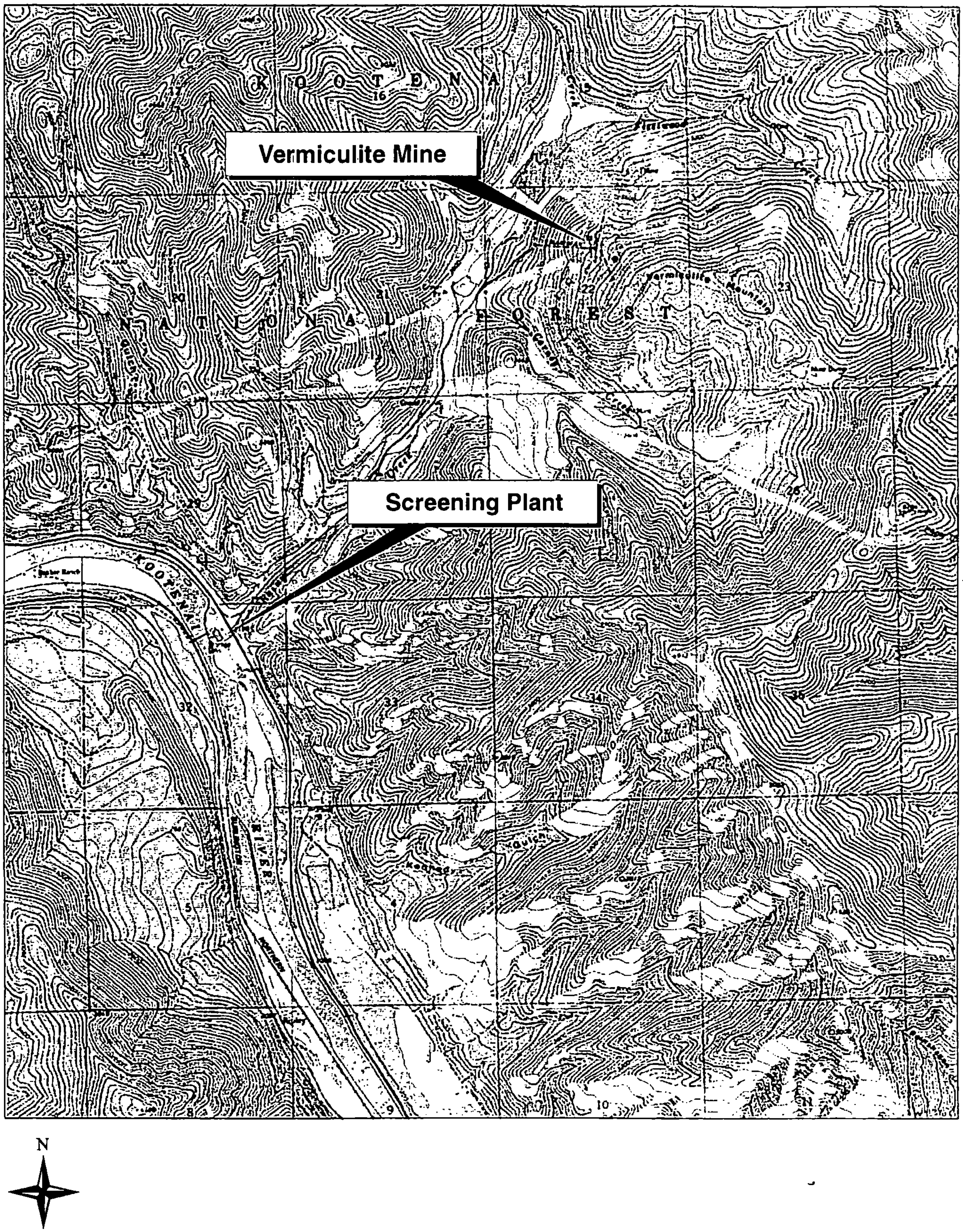


Figure 1-2
Site Location

1.2.2 Historic Usage

Operable Unit 02was utilized to sort mined vermiculite by grade. The vermiculite was transported to Operable Unit 02 by truck, sorted and bulk stored in two sheds at the facility. The vermiculite was then loaded onto a conveyor(s) and transported across the Kootenai River. Once the vermiculite was transported across the river to the railroad track, it was loaded onto rail cars for transportation and distribution and trucked to Operable Unit 01.

1.2.3 Operable Unit 02 Area (Acreage)

Total acreage of Operable Unit 02 includes two sections of the property. These areas will be confirmed by the survey to be performed at the start of the project. Operable Unit 02 is approximately 21.10 acres (according to county records), located on the northeast side of the Kootenai River, approximately 4.5 miles northeast of Libby, Montana. Highway 37 runs through the northeast quarter of Operable Unit 02. The remaining portion of the property is in two parcels. The portion northeast of the highway is a triangular shaped parcel containing approximately 1.83 acres. The balance of the area between the highway and the river is approximately 16.70 acres in size. Of this portion, approximately 5.0 acres are in orchard and pasture in the south portion and 4.0 acres border on the river in the northwest portion. A building site containing approximately 7.70 acres is located in the middle of the property. The overall dimensions of Operable Unit 02 are 608.28 feet on the north; 1317.46 feet on the east; 495 feet on the south; and approximately 1,400 +/- feet along the Kootenai River on the west. These dimensions do not include the railroad loading area on the southwest bank of the Kootenai River.

1.2.4 General Condition

The Operable Unit 02 is accessed through a gated entrance off of Highway 37. Access road conditions vary throughout the property. The main access road is paved, reportedly with asphalt paving (3 to 6 inch overlay) over a graded subgrade with compacted base materials. Unimproved roads are in fair condition; however, vermiculite was visible at a number of locations on and adjacent to these roads. Road access appears to be adequate to support future removal activities. Total area of asphalt and concrete (including building slabs, approximately 62,594 sq. ft.) is 171,994 sq. ft. A large amount of concrete and asphalt paving is located on the building site. There is approximately 99,000 sq. ft. of asphalt paving and approximately 10,400 sq. ft. of concrete paving. The asphalt paving in most cases appeared to have a thickness of 4 to 6 inches. The concrete paving observed had a thickness of 6 to 12 inches.

The improvements at Operable Unit 02 consist of a mix of older industrial buildings and newer commercial nursery structures, together with improvements and landscaping. The buildings consist of an office/dwelling and attached solarium, five or six commercial green houses, a shade house, a large shed, a smaller open-front shed, several auxiliary buildings, and a mobile home. Additional improvements include an aboveground fuel storage tank, an aboveground water storage tank, a large area of concrete and asphalt paving, numerous ornamental plantings, and other landscaping and improvements. Figure 1-3 displays the general layout of Operable Unit 02.

Nursery Office and Owner's Residence

The nursery main office and the owner's residence are located in the center of the property, built on concrete slabs with a wooden frame with steel and fiberboard siding. The roof of the office and residence is enameled steel. The office/dwelling and attached solarium measure as follows:

Dwelling	1,592 sq. ft.
Office	816 sq. ft.
Solarium	304 sq. ft.
STRUCTURAL AREA SUBTOTAL:	2,712 sq. ft.

Greenhouses

The assessor's report noted five (5) greenhouses that were built between 1994 and 1997. The greenhouses are constructed of welded steel tubing on approximately 4-foot centers. The two oldest large greenhouses have air-inflated side walls with steel sided end walls, electric lighting, exhaust fans and are equipped with 250,000 BTU propane space heaters and 30-foot boom sprays. The two newest large greenhouses have no end walls or siding, but are equipped with PVC sprinklers. Four of the greenhouses were built on asphalt paving. The fifth greenhouse has 12 ft. by 12 ft. concrete footings that support the walls. The fifth or south greenhouse is on a concrete slab and equipped with an 180,000 BTU heater, exhaust fans and PVC sprinklers.

Large Greenhouses		
	Four (4) at 5,160 sq. ft. each	20,640 sq. ft.
Smaller Greenhouse		
	One (1) at 2,520 sq. ft.	2,520 sq. ft.
	Extension	720 sq. ft.
STRUCTURAL AREA SUBTOTAL:		23,880 sq. ft.

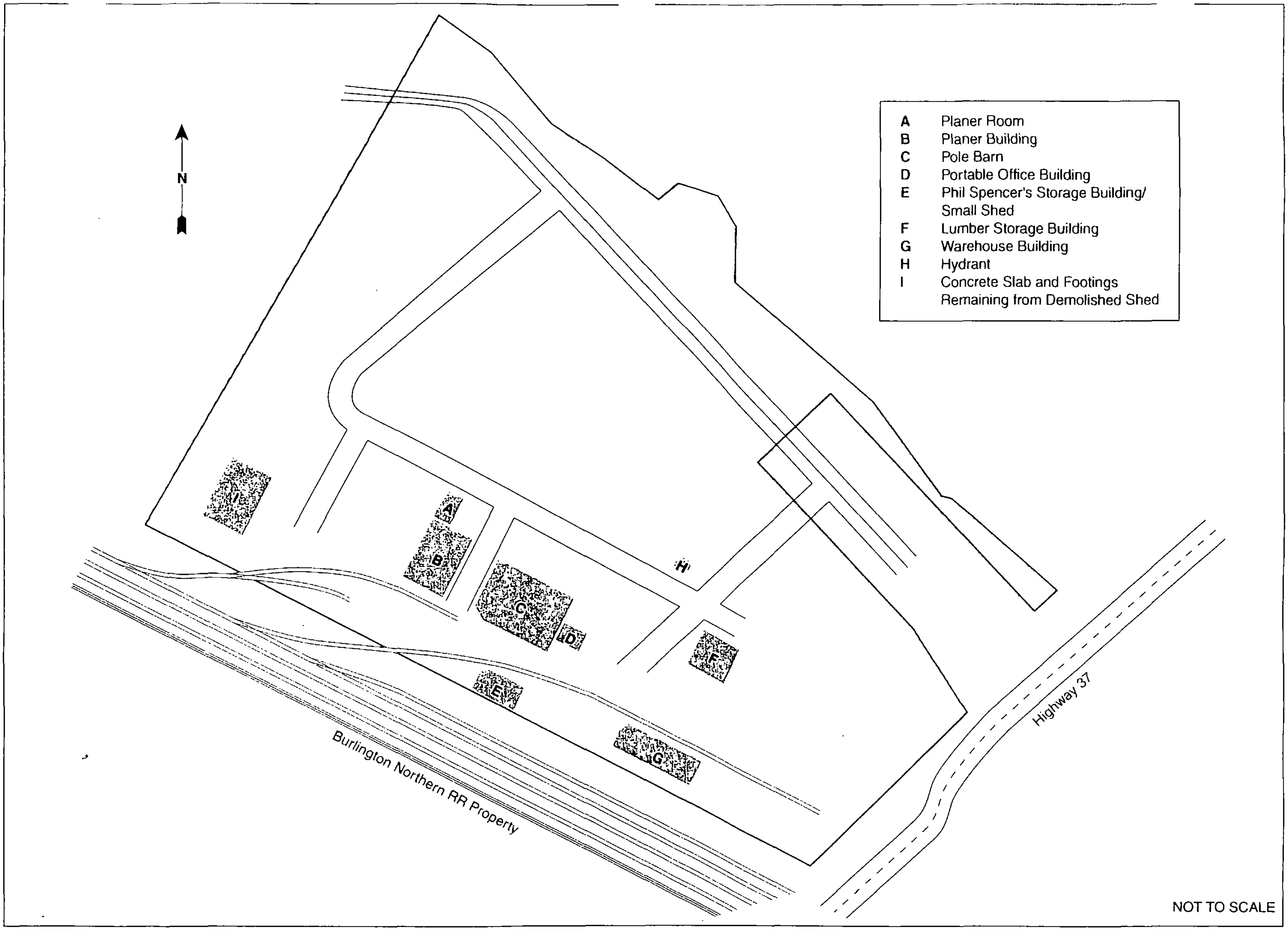


Figure 1-3

Former Exp Facility

DOT Vol Center

Shade House and Fruit Stand

The shade house is reported to be constructed of a metal frame on five-foot centers with a total area of 2,070 sq. ft. The shade house has particleboard end walls and a dirt floor. An additional frame structure used as a fruit stand is located just off of the highway right-of-way. It has a total area of 992 sq. ft. and is constructed of galvanized steel.

Shade House	2,070 sq. ft.
Fruit Stand	992 sq. ft.
STRUCTURAL AREA SUBTOTAL:	3,062 sq. ft.

Long Shed

The long shed is a large partially open shed with dimensions of 140 ft. by 280 ft. = 39,200 sq. ft. with an average wall height of 30 feet. The long shed is the largest building and is located southwest of the owner's residence and main office. The long shed was constructed in a cut slope on the property. The frame is constructed of 6-inch steel "I" beams with reinforced concrete footings. A 10 to 12 inch reinforced concrete slab extends throughout the long shed. The roof of the long shed is constructed of steel girders with overlapping and cascading galvanized corrugated steel deck. The structure appears to be sound and in fair condition. A number of the support columns are twisted and deflected. The roof is in need of repair. The ceiling, between the overlapping corrugated galvanized steel panels, horizontal surfaces, and the interior walls contain vermiculite and other debris.

West Shed

The west shed is a smaller open-front shed and is similar in design to the long shed and constructed of similar materials. The dimensions of the west shed are 37 ft. 6 in. by 108 ft. = 4,050 sq. ft. with an average wall height of 16 feet. The west shed does not have a concrete slab floor. One half of the floor is wood and the other half is a dirt floor. Asphalt paving surrounds the west shed underneath the roof overhang. The west shed is in average to fair condition.

Break Room

Adjacent to the northeast corner of the long shed is the break room. The break room is constructed of a wooden frame with steel siding and roof. The break room was constructed on 10 to 12 in. thick, steel reinforced concrete slabs. The break room's structural area is 187 sq. ft. This structure is in fair condition.

Lab and Extraction Room

The lab and extraction room is a wood frame structure with concrete and wood floors with an overall area of 120 sq. ft. This structure provides direct access to the underground tunnel system.

Long Shed	39,200 sq. ft.
West Shed	4,050 sq. ft.
Break Room	187 sq. ft.
Lab and Extraction Room	120 sq. ft.
STRUCTURAL AREA SUBTOTAL:	43,557 sq. ft.

Underground Tunnels

The underground tunnels are located underneath the long and west sheds and underneath the outside to the southeast of the long shed. The largest tunnel ("L" shaped horizontally) is 470 feet in total length being 5 feet wide and 6 ft. 2 in. tall. The smaller tunnel ("U" shaped horizontally) is located to the southeast of the long shed and is 370 feet in total length. This tunnel varies in width from 5 to 6 feet and is 6 to 7 feet tall. The tunnels have an interior area of 28,500 cu. ft. These tunnels are constructed of steel reinforced concrete approximately 12 in. thick in the floors, walls, and ceilings. The floor area of these structures is approximately 4,570 sq. ft.

"L" Shaped Tunnel	2,350 sq. ft.
"U" Shaped Tunnel	2,220 sq. ft.
STRUCTURAL AREA SUBTOTAL:	4,570 sq. ft.

Manufactured Home/Office

A 1979 Clifton office trailer is located northeast of the nursery office and Owner's residence. Its total area is 395 sq. ft. with dimensions of 10 ft. by 39 ft. 6 in. The trailer is set on blocks and has metal skirting and siding. This office trailer is referred to as the "Guest House."

Manufactured Home/Office	395 sq. ft.
STRUCTURAL AREA SUBTOTAL:	395 sq. ft.

Other Items and Debris Observed

Other items and debris observed at Operable Unit 02include:

- Recreational vehicles (RVs), automobiles, and boats stored inside the long shed
- Steel silos and hoppers stored outside the long shed
- Evaporative cooling units and metal debris stored outside all four sides of the long shed
- Underground storage tanks stored outside the long shed
- Aboveground fuel storage tank
- Aboveground water storage tank
- Nursery inventory and packing material stored throughout the property
- Mushroom farm (3,000+ buckets) housed inside the underground tunnel system
- Four (4) propane tanks, kerosene and diesel ASTs on the property
- Landscaping with 30,000 sq. ft. of grassy lawns, many small trees, and ornamental plants
- Fencing consisting of 6-foot chain link and barbed wire
- Small orchard
- Horse corral

1.2.5 Soil Conditions

Soil conditions observed at the excavations near the underground tunnel entrances consisted of medium grained sand, cobbles (6 inch minus) and boulders. Topsoil at Operable Unit 02 as sandy loam soil containing some silts and clay. Vermiculite was observed in some surface soils adjacent to and on access roads. No exploratory soil samples or boring logs have been reviewed.

1.2.6 Existing Infrastructure and Utilities

Paved access roads, telephone, water, sewage or septic disposal system, and electrical power are available at Operable Unit 02. There may be an underground storage tank (UST) located on the property. A sprinkler system is located on the property.

1.2.7 Existing Vegetation

Existing vegetation consisted of grass, small trees of various types and ages, ornamental plants, and flowers.

1.2.8 Availability of Water

Water is provided to Operable Unit 02 by a cased water well drilled in 1973 that is rated at 30 gallons per minute. Water rights to Rainy Creek include commercial use. The property owner reports that he has water rights to the Kootenai River.

1.2.9 Surrounding Properties

The property lies between Highway 37 on the east side and the Kootenai River on the west. Abutters to the north and south will be identified in the survey. The boundaries of the Wise and Pump House properties located to the south of Operable Unit 02 will be identified in the boundary survey.

1.2.10 Excavation Considerations

Excavation at Operable Unit 02 will need to be conducted in a careful and cautious manner. The property owner reports that the former owner of Operable Unit 02 constructed a number of underground structures on the property. The locations and dimensions of underground structures, other than the tunnels, are unknown at the present time. A test pit excavation program to provide this information is recommended prior to full-scale excavation activities beginning at Operable Unit 02. In addition, the following items will need to be considered when planning an excavation program at Operable Unit 02:

- Historical artifacts
- Dust control
- Trucking access
- Overhead power lines
- Security
- Erosion control
- Underground utilities
- Safety

1.2.11 Cultural Resource Survey

Archaeological Site 24LN1045 was first determined to be eligible for the National Register of Historic Places by the Corps of Engineers (COE) on December 29, 1978. Tests on this site in 1978 and in 1993 through 1994 determined that it contained significant archaeological information. The extent of removal actions at Operable Unit 02 will be coordinated with the findings of a professional archaeologist and EPA with respect to Archaeological Site 24LN1045. Figure 1-4 shows 1994 information from the Montana Historical Society files relative to the location of Archaeological Site 24LN1045 and an exposed artifact area.

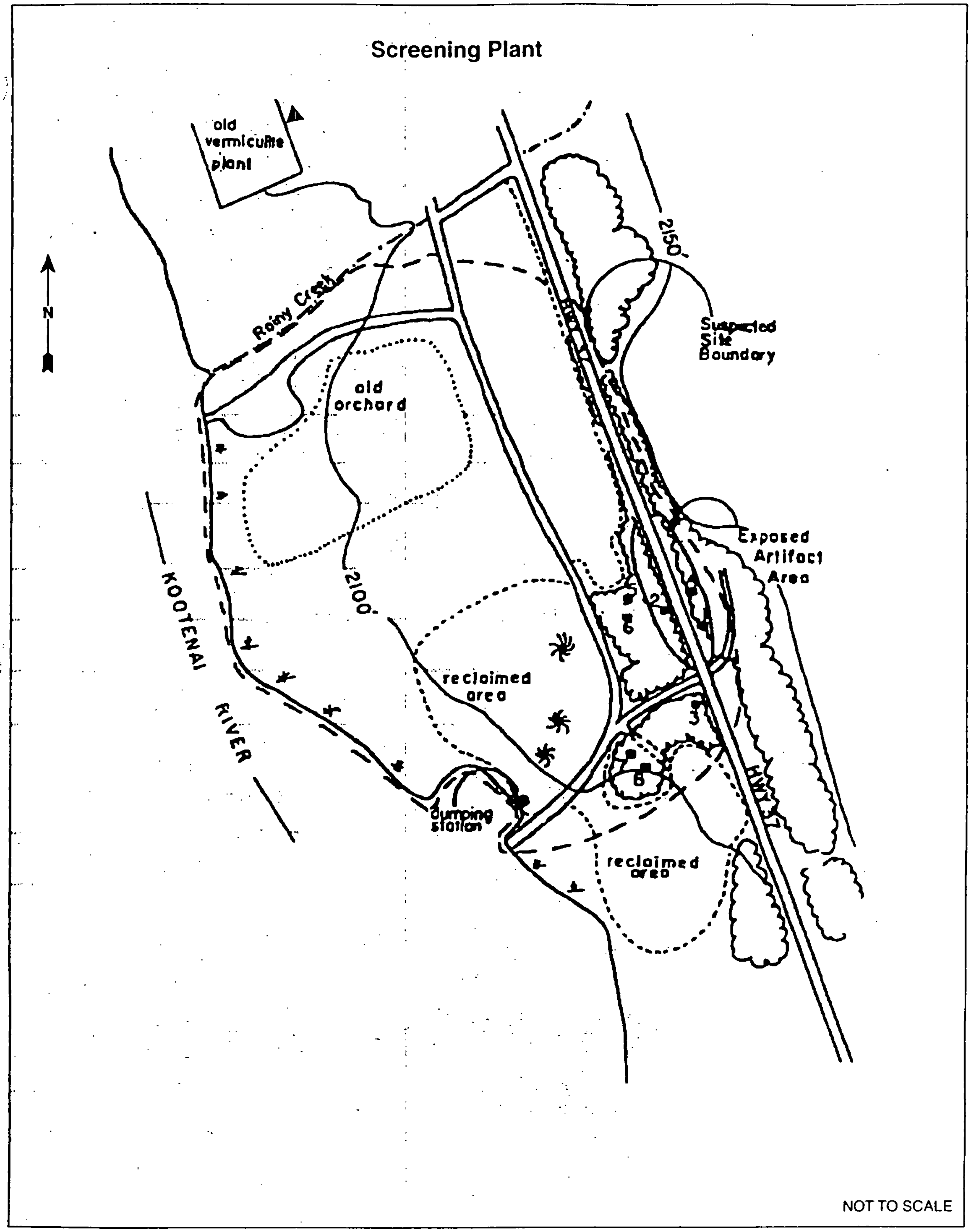


Figure 1-4
Source: Montana Historical Society
1/6/94 Sketch Map for Archaeological Site 24LN1045

1.2.12 Transportation and Disposal Considerations and Options

The closest railroad track is on the other side of the Kootenai River and no loading facility is near Operable Unit 02. Therefore, transport of removal and demolition waste from Operable Unit 02 by rail is not a viable option. All transport of removal and demolition waste from Operable Unit 02 will be by truck.

- Truck loading will need to be done under strict dust control procedures.
- Truck drivers must be asbestos safety trained and wearing appropriate personal protective equipment (PPE) during loading and unloading operations.
- Transportation by tarp covered and lined end dump trucks or by belly dump trucks if determined feasible once disposal sites have been selected.
- The removal contractor will be required to submit a Traffic Control Plan addressing issues such as flag service and closing of Rainy Creek Road by the U.S. Forestry Services during removal operations.
- Excavated soils and demolition debris will be disposed in the location known as Hole #23 on the abandoned vermiculite mine and then covered.
- The removal contractor will be required to submit for review by the EPA, prior to initiating removal action activities, a Dumping/Dust Control Plan for dumping at Hole #23.
- Disposal of demolition debris to off-Site licensed and permitted landfills is an option.
- Disposal of asbestos containing materials to off-Site licensed and permitted landfills is an option.
- Disposal of contaminated soils to off-Site licensed and permitted landfills is an option.

1.2.13 Special Considerations

- Relocation of owners during removal/demolition actions.
- Prior to starting work on Operable Unit 02, an aerial photograph and detailed land survey performed by a State of Montana Registered Surveyor to determine topography, locations of all improvements, physical features, property boundaries, and soil sample locations will be required.

- It is presently planned to remove a maximum 18 inches of soil from areas of Operable Unit 02 determined by surface soil sampling to contain asbestos contaminated soils. In these locations, EPA has elected to remove the top 12 inches of soil, perform confirmatory soil sampling and, following receipt of soil sampling results, remove an additional 6 inches of soil, if required. At this time, the maximum depth of soil to be removed from confirmed contaminated areas of Operable Unit 02 is 18 inches.
- Construction quality control
- Health and safety plan
- Dust control and decontamination water collection and recycling
- Continuous air monitoring
- Individual personnel air monitoring
- Access restrictions
- Strict access control
- Personnel and equipment decontamination facilities

Section 2
Removal Action Work Plan

2.1 Logistical and Special Considerations

2.1.1 Operable Unit 02

The Operable Unit 02 is used primarily as a fully operational retail nursery business for growing, storing and selling of plants, flowers, trees, and related items. The general public has unrestricted access to the property during normal business hours. During asbestos abatement and building demolitions, the owners should not be residing on Operable Unit 02 nor should customers be allowed on the property. The nursery business will not be operational during the removal activities. Relocation to another location on the property during the removal action is not a feasible alternative. About one-third of the long shed is used to store nursery supplies, tools, and various pieces of equipment used in their nursery business. These items may be contaminated with asbestos fibers and may need to be cleaned prior to reuse or disposed of as asbestos containing material and replaced. Also, the mushroom growing operation in the underground tunnels needs to be removed prior to demolition of the tunnels. Approximately 3,000 two to four gallon buckets filled with vermiculite used to grow a certain species of mushroom are presently in the tunnels.

The remaining two-thirds of the long shed's space is used as leased storage. Recreational vehicles (RV), trailers, boats, automobiles, and numerous other articles belonging to others are stored in the long shed. An inventory of the items stored in the long shed, and the ownership of each article, needs to be determined prior to asbestos removal of this building. Microvacuum dust tests of some items stored in the long shed have been obtained and the results indicate significant concentrations of asbestos fibers. Consequently, it is very likely that many of the articles stored in the long shed may be contaminated with asbestos fibers and need to be cleaned and inspected to confirm that they have been satisfactorily decontaminated before leaving Operable Unit 02 and returned to their respective owners.

State of Montana Bills of Lading (BOL) will be prepared by the removal/demolition contractor for each truckload of waste leaving Operable Unit 02 and disposed at Hole #23. All record keeping shall be in accordance with EPA's On Scene Coordinator (OSC) and Remedial Cost Management System (RCMS) protocols. EPA will sign all BOLs.

2.1.2 Disposal at Abandoned Vermiculite Mine

All removal and demolition debris will be disposed at Hole #23 (see discussion of disposal at the abandoned vermiculite mine tailings pile below). Once all materials are disposed at the abandoned vermiculite mine, the debris will be covered and the Hole #23 location graded. State of Montana coordination for this work is anticipated. The owner of the abandoned vermiculite mine will also need to allow disposal on its property. In conducting this activity, EPA will, to the extent practical, comply with all applicable or relevant and applicable requirements (ARARs).

The State of Montana and EPA have considered placing asbestos contaminated soil removed from Operable Unit 02 at the eroded area of the abandoned vermiculite mine tailings pile. However, in order to dispose of soil in this location, a substantial engineering evaluation is required. The eroded area of the abandoned vermiculite mine tailings pile is located in the proximity of the dam and active spillway. A topographic survey and geotechnical evaluation of the tailings pile stability and capability to support excavation equipment needs to be performed. In addition, an evaluation of the existing dam is necessary as part of this evaluation. A temporary roadway from Rainy Creek to this disposal area would need to be designed and constructed. The roadway would need to include a culvert in order to permit uninterrupted operation of the spillway throughout the construction and disposal operation. The aggressive schedule established by EPA for performing the removal action at Operable Unit 02 does not include time for conducting this evaluation and related activities. Therefore, Hole #23 remains the favored location for disposal of all materials removed from Operable Unit 02 under the planned time-critical removal action.

2.1.3 Project Execution Plans

Prior to initiation of removal action activities, the removal contractor will be required to submit, at a minimum, the following plans for review by the Government Agencies having jurisdiction on this project:

- Traffic control
- Dust control
- Erosion control
- Demolition/dismantling
- Transport and disposal plan
- Equipment decontamination plan

2.1.4 Test Pit Program

CDM will develop specifications for conducting a test pit excavation program. The test pit excavation program will be conducted once the detailed surveys of Operable Unit 02 has been received, reviewed, and accepted. The current owner of Operable Unit 02 will be requested to participate by identifying known or suspect locations of underground structures.

2.2 Information Needs for Remedial Design Plans and Specifications

The following work elements need to be performed in order to provide the information needed to effectively manage, control, and document removal and demolition activities at Operable Unit 02.

2.2.1 Conduct Land Survey

A detailed property line survey and topographic survey will need to be prepared for Operable Unit 02 by a registered land surveyor licensed in the State of Montana prior to initiation of removal action activities. All physical features and structures on Operable Unit 02 will need to be located on the survey. Information obtained from the surveys will be in both reproducible hard copy and AutoCAD electronic format. The surveys will be used to establish air monitoring locations, limits of work areas, confirm existing building locations and dimensions, identify abutters, and to prepare a grading plan.

2.2.2 Plantings Survey

A walkover will be made by EPA, the Volpe Center and, the owners of Operable Unit 02 to determine which shrubs and trees are to be salvaged. Flagged trees and shrubs will be carefully excavated, balled and burlapped, and maintained by the removal contractor throughout the removal/demolition process.

2.2.3 Removal of Potential Regulated Asbestos Containing Materials (RACM) and Demolition of All Structures

All structures are known to contain RACM. To facilitate demolition and disposal of all building components, each building will be decontaminated using high vacuum machinery with high efficiency particulate air (HEPA) filters prior to dismantling and demolition. All decontamination, dismantling, and demolition activities will be conducted in a manner such that no visual dust emissions are observed, in accordance with National Emission Standards for Hazardous Air Pollutants (NESHAPS), asbestos (40 CFR Part 61, Paragraph 61.145) regulations.

All demolition debris will be disposed at Hole #23 in the abandoned vermiculite mine. The removal/demolition contractor will be responsible for thoroughly washing down all trucks prior to their leaving Operable Unit 02. No mud or dust will be permitted on Highway 37.

Prior to decontamination and demolition activities, the removal/demolition contractor shall prepare the previously referenced plans. With respect to dust control on the highways and roads where removal debris will be transported, it is planned to use liquid magnesium chloride for dust control. Water misting of structures during demolition will be required.

Following removal and disposal of all contents, the underground tunnels will be washed down and the roofs broken up and dropped into the tunnels. Remaining portions of the tunnels will be filled in with common fill.

2.2.4 Removal of Potential Asbestos Containing Soils

Once all stored items on Operable Unit 02 have been removed and disposed or relocated, and buildings demolished, soil removal will begin. Based on the results of surface soil sampling, 12 inches of contaminated soils will be removed from areas of known contamination. Confirmatory soil sampling will follow. If contaminated soil is confirmed by the supplemental sampling, an additional 6 inches of soil will be removed to a maximum depth of 18 inches. Following removal of a maximum of 18 inches of soil, the excavated areas of Operable Unit 02will be covered with 12 inches of common fill and 6 inches of gravel compacted to be suitable for future asphalt paving. Areas not anticipated to be paved will be covered with 12 inches of common fill and 6 inches of topsoil and hydroseeded. It should be noted that future excavations at depths greater than these presently proposed for soil removal may pose the risk of exposure to asbestos contaminated soils at greater depths.

2.2.5 Inventory and Removal of Property Contents

As has been discussed earlier in this section, an inventory of items belonging to others and stored on a lease basis in the long shed at Operable Unit 02 will be made by the Volpe Center. A detailed asbestos survey of items stored on the property would be extremely time consuming and is therefore not recommended. As an alternative, all articles stored in a building shall be assumed to be contaminated with asbestos fibers and decontaminated and relocated, or disposed as determined during the survey.

There will be three categories of inventory:

- No value - owner agrees and labels as trash for disposal.
- Of value - clean and return to owner.
- Of value - however, more economical to dispose and either replace with new or provide owner with fair compensation.

All stored articles shall be thoroughly decontaminated by washing followed by visual inspection prior to their disposal or return to their proper owners. Items not compatible with standard decontamination procedures will need to be legally disposed and their owners fairly compensated.

2.2.6 Prepare Health and Safety Plan Requirements

The removal action contractor will be responsible for developing and implementing a Health and Safety Plan for all removal actions and demolition activities at Operable Unit 02. The Health and Safety Plan will be developed and implemented in accordance with the U.S. Occupational Safety and Health Administration (OSHA)

Standard 29 CFR Part 1910 and Part 1926, Occupational Safety and Health Standard for the Construction Industry, and all applicable OSHA Health and Safety Requirements.

The Health and Safety Plan will be reviewed and approved by a Certified Industrial Hygienist (CIH) prior to initiating removal actions. All modifications to the Health and Safety Plan that are required during the removal action at Operable Unit 02 will also be reviewed and approved by the project CIH prior to being implemented. The Health and Safety Plan will be included in the removal action specifications and will address the following:

- Overview of the potential hazards of the work
- Identification of safe work practices
- Training and medical monitoring requirements
- Personal protective equipment requirements
- Communication and emergency notification procedures
- Project documentation

Once the Health and Safety Plan has been approved by the CIH, the removal action contractor will review the plan with all removal action personnel. All removal actions at Operable Unit 02 will be conducted in strict accordance with the approved Health and Safety Plan.

2.2.7 Prepare Construction Quality Control and Quality Assurance Plan

The text portion of the Sampling and Quality Assurance Project Plan developed by EPA is provided in Appendix B. Applicable requirements of this plan will be implemented during the removal/demolition activities described in this RAWP.

2.2.8 Prepare Air Monitoring Requirements

Air monitoring will be conducted to determine airborne dust and asbestos fiber levels during the removal actions. Air monitoring will be performed by the air monitoring consulting firm and by the removal action contractor. Air monitoring will be performed prior to the initiation of removal actions to determine background levels of dust and fibers in the air. Air monitoring will be performed during removal actions and demolition activities to ensure that dust and fibers are not being released from the work areas during removal actions, determine the appropriate level of respiratory protection for removal action workers, and to document dust and fiber levels following the removal actions.

Air monitoring will be performed using continuous aerosol monitors and by collecting samples for analysis by transmission electron microscopy (TEM). The MIE DataRAM™ Portable Real Time Aerosol Monitor will be used to conduct continuous air monitoring on the perimeter of Operable Unit 02 to determine the total mass of airborne dust and fibers (expressed as micrograms per cubic meter (ug/m^3) of air). Air samples that will be analyzed by TEM will be collected and analyzed in accordance with Appendix A of the EPA's AHERA regulation (40 CFR Part 763) in accordance with ISO 10312 counting rules. Sample results analyzed by TEM will be expressed as asbestos structures per square millimeter ($structures/mm^2$).

Background Air Samples
The air monitoring consulting firm will collect background air samples at Operable Unit 02 to determine background airborne asbestos fiber levels prior to the start of the emergency removal action. The consulting firm will collect air samples for TEM analysis at identical locations on Operable Unit 02 on two different days to determine background airborne asbestos fiber levels. The background air samples will be compared to the final clearance air samples to ensure that airborne asbestos fiber levels at the completion of the removal action are equal to or lower than the asbestos fiber levels present prior to initiating the removal action.

Ambient Daily Air Monitoring
The air monitoring firm will conduct air monitoring during the removal action at Operable Unit 02 to ensure that airborne dust and fibers are not being released during the removal action. The air monitoring firm will collect air samples along the perimeter of Operable Unit 02, in clean rooms, and at the exhaust of negative air machines.

The air monitoring firm will place up to eight MIE DataRAM™ Portable Real Time Aerosol Monitors along fixed locations along the perimeter of Operable Unit 02. The DataRAMs will provide continuous monitoring of the total mass of airborne particulates on the perimeter of Operable Unit 02. The air monitoring firm will also collect air samples for TEM analysis at these same fixed locations on the perimeter of the project to determine the concentration of airborne asbestos fibers. The air monitoring firm will analyze the data collected from the DataRAM and the TEM analyses to establish trends between airborne particulate levels and asbestos levels.

The air monitoring firm will also collect air samples in the clean rooms of decontamination chambers, at the exhaust of negative air machines, and other appropriate areas on Operable Unit 02. The purpose of these samples is to document that clean rooms are actually clean and that the negative air machines are not exhausting asbestos fibers.

OSHA Compliance Air Samples
The removal action contractor will collect daily personal air samples on its workers to document compliance with the Occupational Safety and Health Administration's (OSHA) Asbestos Standard for the Construction Industry (29 CFR Part 1926.1101).

The removal action contractor will collect time-weighted average (TWA) and excursion samples from ten percent (or a minimum of two) of the workers each day removal action work is performed. The TWA samples will be started at the beginning of each work day and will be turned off at the conclusion of each work day. TWAs will be adjusted using the Brief and Scala Method for workdays that last longer than eight hours. Thirty-minute excursion samples will be collected from workers during work activities that are expected to generate the highest fiber levels.

The results of the TWA and excursion samples will be compared to the Asbestos in Construction Standard to determine if the level of respiratory protection worn by removal action workers is adequate.

Ambient Final Clearance Air Samples
After each building or structure on Operable Unit 02 has been decontaminated, the air monitoring firm will perform a detailed visual inspection of the building or structure to ensure that vermiculite and dust have been adequately removed. Since each building and structure at Operable Unit 02 will be demolished, final clearance air samples are not required prior to demolishing the building or structure. Therefore, once a building passes the final visual inspection, the building can be dismantled.

At the conclusion of the removal action for the Operable Unit 02, the air monitoring firm will collect final clearance samples. The air samples will be collected and analyzed by TEM. The samples will be collected at the same locations as the background samples collected prior to the initiation of the removal action. These samples will be compared to the background air samples to ensure that airborne asbestos fiber levels at the completion of the removal action are equal to or lower than the background fiber levels.

2.2.9 Prepare Decontamination and Dust Suppression Requirements

2.2.9.1 Decontamination and Dust Suppression Requirements

The contents of the buildings and structures and the buildings and structures themselves will be decontaminated by the removal contractor during the removal actions at Operable Unit 02. In addition, construction equipment such as backhoes and trucks will be decontaminated prior to leaving Operable Unit 02. Removal action personnel will be required to decontaminate themselves at the end of each work shift before leaving Operable Unit 02. Prior to the start of the removal actions, specific decontamination and cleaning procedures will be developed and included in the removal action specifications.

2.2.9.2 Decontamination Procedures

Prior to the initiation of removal actions, specific decontamination and cleaning procedures will be developed and included in the removal action specifications for Operable Unit 02. The specifications will include the requirements for decontaminating personnel, construction equipment, contents of the buildings, and the buildings themselves. The following paragraphs provide an overview of the decontamination and cleaning activities.

2.2.9.3 Personnel Decontamination

The removal action contractor will furnish and install separate personnel decontamination facilities at Operable Unit 02 for male and female removal action workers to shower at the completion of each work shift. The decontamination facility will consist of a minimum of a clean room, shower room, and dirty room separated by air locks. The facility will have hot and cold running water, and will have a negative air system that prevents fibers from being released into the clean room. All shower water will be filtered to remove asbestos fibers before being released to the environment. Workers will enter the dirty room, remove their protective clothing, step into the shower room and shower, and then enter the clean room before taking work breaks or leaving Operable Unit 02 for the day. The personnel decontamination facility will be available for use by the engineer, federal, and state agency personnel throughout the duration of the project.

2.2.9.4 Decontamination of Construction Equipment

A variety of construction equipment and vehicles, such as backhoes, loaders, dump trucks and bobcats, will require decontamination before leaving Operable Unit 02 to prevent asbestos contaminated soil from being tracked off Operable Unit 02. The removal action contractor will be required to construct a decontamination facility and asphalt paved roadway at Operable Unit 02 to decontaminate equipment and vehicles. The equipment or vehicles to be decontaminated will be driven to the pad and washed with water to remove visible signs of soil and mud from the exterior of the equipment or vehicle. The water will be collected for filtration and/or disposal in accordance with the removal contractor's approved Health and Safety Plan.

2.2.9.5 Decontamination of the Contents of the Buildings

The removal action contractor will set up a separate decontamination facility at Operable Unit 02 for removal action workers to decontaminate and reclaim (to the extent possible) the contents of the buildings. The removal action specifications will provide detailed procedures for decontaminating items that will include the use of high efficiency particulate air (HEPA) vacuum cleaners and/or rags wetted with amended water. Decontamination of these items will take place in a decontamination facility that is separate from the personnel decontamination facility.

The decontamination facility will consist of a minimum of a clean room, cleaning room, and dirty room separated by air locks. The facility will have running water, and will have a negative air system that prevents fibers from being released into the clean room. All water will be filtered to remove asbestos fibers before being released to the environment. Filtered water will be sampled and analyzed to confirm asbestos fibers have been removed. The contents of the buildings will be taken through the dirty room and handed to personnel in the cleaning room to be decontaminated. After each item is cleaned, the decontaminated item will be handed to personnel in the clean room to be taken to a temporary storage facility.

2.2.9.6 Decontamination of the Buildings

Once the contents of the buildings have been removed and decontaminated, the removal action contractor will perform a gross decontamination of the buildings. The removal action specifications will provide detailed procedures for gross decontamination of the buildings that will include the use of HEPA vacuum cleaners, amended water, and/or rags and mops. Once a building has been decontaminated and inspected by the air monitoring firm, the removal action contractor will, <u>when appropriate</u>, spray a lock down encapsulant onto building surfaces to lock down any residual fibers.

2.2.9.7 Dust Suppression Procedures

The removal action will include dust suppression procedures to prevent asbestos contaminated dust from migrating off Operable Unit 02. Consideration will also be given to controlling dust on Rainy Creek Road generated by trucks hauling waste to Hole #23 at the abandoned vermiculite mine. The removal action specifications will include detailed requirements for dust suppression that will include the use of liquid magnesium chloride dispensed by water trucks on Operable Unit 02 and on Rainy Creek Road. Water spraying and misting will be required continuously during demolition activities. The air monitoring firm will conduct visual observations and air monitoring of Operable Unit 02 to ensure that the removal contractor's dust suppression techniques are adequate.

2.2.10 Anticipated Specifications and Drawings

Anticipated Specifications

<u>Division 1 - General Requirements</u>

Summary of Work	01010
Measurement and Payment	01025
Control of Work	01046
Field Engineering	01050

Special Provisions	01170
Project Meetings	01200
Submittals	01300
Construction Scheduling	01311
QA/QC Plan	013xx
Testing and Laboratory Services	01410
Temporary Facilities	01500
Contract Closeout	01700
Division 2 - Operable Unit 02 Work	
Decontamination	02050
Demolition	02055
Earthwork (Soils Removal, Disposal, Backfill, Compaction and Grading)	02200
Sediment and Erosion Control	02270
Chain Link Fence	02830
Asphalt Paving	02xxx
Loam and Hydroseed	02xxx
Division 13 - Special Construction	
Liquid Waste Management	13574
Hazardous and Non-Hazardous Material Management	13575
Health and Safety Plan Requirements	13680
Emergency Response Requirements	13685
Ballasts, Transformers, Mercury Switches, Hydraulic Fluids Management	13695

Air Monitoring	13xxx
Decon and Dust Suppression	13xxx
Asbestos Abatement	13xxx

Anticipated Drawings

Operable Unit 02 Existing Conditions Plan

Operable Unit 02 Demolition Plan

Operable Unit 02 Erosion Control Plan

Operable Unit 02 Grading Plan

Section 3
Remedial Action Equipment and Manpower Needs

3.1 Operable Unit 02 Plant Removal/Demolition Activities

3.1.1 Mobilization

Initial mobilization for this project will be performed in preparation of Operable Unit 02 decontamination, asbestos abatement, facility dismantling, and demolition portion of the work.

3.1.2 Set Up Temporary Facilities

Temporary facilities shall consist of the following items and structures:

Office Trailer - One government office trailer (60 ft. by 14 ft.) with offices in each corner and a conference room in the middle. The government office trailer shall have two voice phone lines and one dedicated facsimile line. Two 60 ft. by 10 ft. office trailers for construction support with offices on each end and a conference room in the middle. These office trailers shall have two voice phone lines and one dedicated facsimile line. All offices shall be equipped with personal computers or laptops, drinking water dispensers, refrigerators, facsimile machines, copiers, and telephone. A VHS video camera set up with a VCR and remote shall be provided and installed in the government office trailer. Garbage collection service shall be provided to support operations at Operable Unit 02.

Decon Trailer - The decon trailer shall be equipped with lockers for all personnel, clothes washer and dryer, and a shower. It shall be a 40-foot box trailer with a small office on one end for the Project Superintendent.

Temporary Electrical Power Service - Electrical power shall be provided through the existing service and hard wired into the office trailers.

Tool Shed - The tool shed shall be staged adjacent to the office trailer and contain tools, PPE, and small equipment. The tool shed shall be an 8 ft. by 40 ft. roll-off steel storage container that shall be wired for electrical service and lights.

Portable Toilets - Portable toilets for male and female workers and agency personnel shall be staged in the Support Zone and workers must exit through the personnel decontamination facility in order to access these facilities. The number of toilet seats and urinals shall be in accordance with the requirements of 29 CFR 1910.120(n)(3)(I), however, there shall be at least three portable toilets with hand washing facilities at Operable Unit 02. Portable toilets shall be emptied and cleaned, and liquids, disinfectants, paper, etc. replaced or resupplied every other day during the removal activities.

Security Fence – Temporary security fencing shall be erected around the office trailer, tool shed, and construction equipment storage area. Security fencing shall be chain link fence with driven (not drilled and cast-in-place) corner and line posts.

Construction Equipment Storage Area – The construction equipment storage area shall be at least 40,000 ft. sq. encompassing the office trailers, tool shed, facility parking lot, and all heavy equipment stored at Operable Unit 02 when not in use.

Contaminated Materials Staging Area – A temporary holding area for RACM waste shall be constructed on Operable Unit 02 with a soil berm stacked at least two feet high for spill containment. This facility shall be constructed during the "Set Up Temporary Facilities" task and provided to store hazardous or potentially hazardous waste on a temporary basis. The final disposition of wastes stored in this area shall be determined as soon as possible.

Hazardous Materials Storage Area – A temporary staging area for hazardous materials such as fuel, lubricating oils, chemicals storage, PCB light ballasts and other hazardous and regulated materials removed from Operable Unit 02 and from structures prior to their demolition shall be constructed on Operable Unit 02. The area shall be bermed around the perimeter.

Recyclable Materials Storage Area – A recyclable materials storage area shall be established for demolition debris or salvageable items determined to be acceptable for recycling. It shall be strategically placed at the facility where transportation and disposal can easily occur.

3.1.3 Construct Decontamination Facility

Personnel decontamination facilities shall consist of personnel showers, eyewash stations, personal protective equipment (PPE) storage, tables, and chairs for personnel.

Equipment decontamination facilities shall be constructed of a 20 ft. by 45 ft. by 6 in. excavation lined with 20 mil plastic with a sump on the low corner for water collection. The liner shall be covered with 1 inch clean gravel so that decon water can easily percolate through the gravel, onto the plastic and be collected in the sump. Decon water shall be containerized in one of the 21,000 gallon water storage tanks for treatment, recycling, or off-Site disposal.

Structural decontamination facilities shall consist of French drains around the perimeter of the structural slabs, and the use of booms and dikes to collect decontamination water. Plastic sheeting shall be wrapped around the exterior walls of these structures to collect overspray and mitigate dust.

3.1.4 Decontaminate and Remove Salvageable Inventoried Property

Salvageable items inventoried and decontaminated shall be recycled or reused as deemed appropriate. These items shall be removed from each structure, passed through the decontamination facility, inspected and analyzed for residual contamination. If any item is determined to require further decontamination, then the process shall be repeated until determined clean. The salvageable items shall be staged in the recyclable materials storage area and prepared for off-Site shipment.

3.1.5 Dispose of Non-Salvageable Inventoried Items

Non-salvageable items shall be staged either in the Hazardous Waste Storage Area or the Recyclable Items Storage Area. The appropriate storage area for non-salvageable items shall be determined by inspection and sample analyses.

3.1.6 Dismantle Structures

The structures requiring dismantling are the long shed and west shed. These structures are in need of roof repairs and their structural integrity would need to be confirmed by a licensed Montana structural engineer before considering them economically feasible to keep in service. These structures contain vermiculite that is lodged in between structural members and cavity walls. Dismantling these structures will be accomplished using hand tools and using the CAT 330 L Excavators under a constant water spray to mitigate and control dust. Personnel shall access the roof of these structures using the platform lift, boom lift, and forklift with personnel basket. The roof of these structures shall be dismantled first, followed by the interior walls. Exterior walls shall remain and be decontaminated in place.

3.1.7 Remove RACM

RACM that are lodged in between structural supports, metal siding, inside interior walls, and on surfaces throughout each structure shall be removed, bagged, containerized, and staged in the Hazardous Waste Storage Area where it shall be prepared for transportation. Transportation and disposal of RACM shall occur when adequate quantities of the waste have been accrued to maximize transportation efficiency.

3.1.8 Controlled Demolition or Dismantling of Structures

Controlled demolition of each structure shall not occur until it has been established that all RACM have been properly removed. A Certified Industrial Hygienist shall perform air monitoring, inspection, and clearance prior to initiating the demolition process. By the time the demolition process is ready to begin, the only remaining portions of the structures shall be the supporting steel frames and exterior walls. The entire structure shall be completely decontaminated to minimize the generation of dust during the demolition process. The CAT 330 L Excavator with shear attachment shall cut cross members and supports while the CAT 330 L Excavator with a thumb attachment pulls the structure down. The process shall be repeated as needed until the entire structure has been brought to the ground. Water spray, air monitoring, and visual inspection shall be done continuously during this process to mitigate and control dust.

Asphalt and concrete structures and slabs shall be removed using a CAT 330 L Excavator. The asphalt and concrete shall be staged and pulverized using the CAT 330 L Excavator with a pulverizer attachment. The pulverized concrete and asphalt shall be staged for transportation to the abandoned vermiculite mine for disposal.

3.1.9 Excavation

Prior to the excavation of asbestos contaminated soils, Operable Unit 02 shall be cleared and grubbed of all vegetation, as necessary, using appropriate equipment. Excavation of the soil at Operable Unit 02, as directed by the EPA, shall be done using appropriate equipment. The overall area of Operable Unit 02 is approximately 16.70 acres. If 18 inches of soil were to be removed from Operable Unit 02, the estimated volume of soil is calculated as follows:

1 acre = 43,560 sq. ft. times 1.5 feet (excavation depth) = 65,340 cu. ft. per acre times 16.70 = 1,091,178 cu. ft. times 1.25 for expansion = 1,363,972.5 cu. ft. divided by 27 = 50,517.5 cubic yards to material to be excavated and removed. The volume of soil underneath the long shed should be subtracted from this amount since the long shed slab shall not be demolished and removed. The long shed slab covers an area of 39,200 sq. ft. Therefore, 39,200 sq. ft. times 1.5 feet (excavation depth) = 58,800 cu. ft. times 1.25 for expansion = 73,500 cubic feet divided by 27 = 2,722.22 cubic yards. The actual estimated volume of soils to be removed from Operable Unit 02 is 50,517.5 - 2,722.2 = approximately 47,795.3 cubic yards.

Up to an estimated 50 cubic yards of additional soils requiring excavation, transportation and disposal are located across the Kootenai River and adjacent to the railroad tracks where the conveyor system from Operable Unit 02 deposited vermiculite for loading onto rail cars for off-Site transportation.

The soils shall be excavated under a constant water spray provided by fixed water cannon and water trucks. Dust control and suppression is a major concern and shall be continuously monitored by visual inspection and air monitoring.

3.1.10 Waste Loading and Transportation

All demolition debris not recycled shall be loaded onto end dump trucks for disposal at Hole #23. All demolition debris including steel, wood, concrete, asphalt pavement, etc. shall be reduced to a size capable of being readily and efficiently loaded into end dump trucks. It is anticipated that hydraulic shears, pavement breakers/pulverizers, and other appropriate demolition equipment will be used for this purpose. The soils shall be loaded into lined end dump trucks for transportation and disposal at Hole #23 at the abandoned vermiculite mine or at a facility that is licensed and permitted by the State having jurisdiction.

3.1.11 Waste Disposal

Waste materials will be disposed at Hole #23 or as follows. RACM requiring disposal at a licensed facility permitted to accept RACM shall be transported to a facility in Spokane, Washington. Demolition debris suitable for recycling shall be recycled or disposed at the Lincoln County Landfill. All solid wastes disposed at Hole #23 shall be deposited daily in a manner such that the area can be graded to a reasonably smooth and flat surface. Soils excavated from Operable Unit 02,will be placed on top of the solid wastes, graded to a smooth, relatively flat surface acceptable to the Volpe Center and EPA. Once all soils to be removed from Operable Unit 02 are disposed at Hole #23, the disposed material will be covered with one foot of common fill, 6 inches of topsoil, and be hydroseeded with native grasses and plantings.

3.1.12 Import Clean Backfill Material

Imported backfill materials are available from various local sources. The estimated volume of imported materials should be 47,795.3 cubic yards times 1.5 tons per yard = 71,692.95 tons.

3.1.13 Backfill and Compact

Backfill and compaction shall be accomplished using a CAT D8 Dozer, CAT 140G Motor Grader and water trucks. Compaction shall be done using "wheel rolled" techniques in loose lifts to promote revegetation of the native plants. The building slab underneath the long shed shall be buried with imported materials. Depth of fill material to be determined.

3.1.14 Grading

Finish elevations, lines and grades shall be similar to the elevations and grades of the pre-existing conditions at Operable Unit 02.

3.1.15 Restoration

Upon completion of the grading, a hydroseeding mixture of native plants shall be applied to restore vegetation at Operable Unit 02.

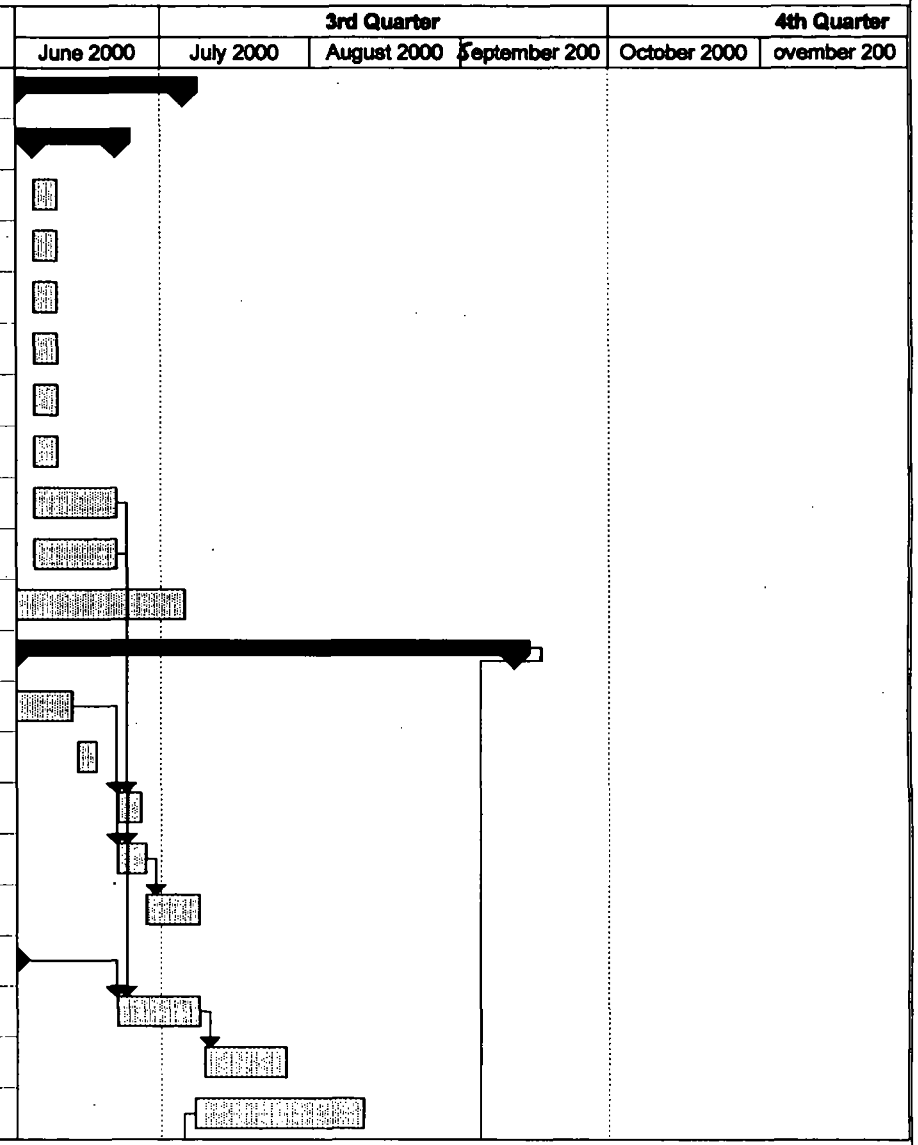
Color Chart(s)

The following pages contain color that does not appear in the scanned images.

To view the actual images, please contact the Superfund Records Center at (303) 312-6473.

LIBBY ASBESTOS PROJECT
SCREENING FACILITY (OPERABLE UNIT 02) REMOVAL ACTION

ID	Task Name	Duration	Start	Finish
1	**Pre-Construction Phase - Screening Facility**	**30d**	**06/01/00**	**07/05/00**
2	**Prepare Plans**	**15d**	**06/05/00**	**06/21/00**
3	Demolition Plan	5d	06/05/00	06/09/00
4	Transportation and Disposal Plan	5d	06/05/00	06/09/00
5	Traffic Control Plan	5d	06/05/00	06/09/00
6	Grading Plan	5d	06/05/00	06/09/00
7	Dust Control Plan	5d	06/05/00	06/09/00
8	Erosion Control Plan	5d	06/05/00	06/09/00
9	Health and Safety Plan	15d	06/05/00	06/21/00
10	QA/QC Plan	15d	06/05/00	06/21/00
11	**Procurement of Subcontracted Goods and Services**	**30d**	**06/01/00**	**07/05/00**
12	**Construction Phase - Screening Facility**	**88d**	**06/01/00**	**09/11/00**
13	Mobilization (RCMS, Review Removal Scheme)	10d	06/01/00	06/12/00
14	Set-up Temporary Facilities, Prep Of Property	4d	06/14/00	06/17/00
15	Construct Decontamination Facilities	4d	06/22/00	06/26/00
16	Inventory and Organize All Materials	5d	06/22/00	06/27/00
17	Move, Return or Dispose Inventoried Property	10d	06/28/00	07/08/00
18	Relocate Residents	0d	06/01/00	06/01/00
19	Remove RACM/Gross Contamination	15d	06/22/00	07/08/00
20	Controlled Demolition/Dismantling Structures	15d	07/10/00	07/26/00
21	Excavation	30d	07/08/00	08/11/00

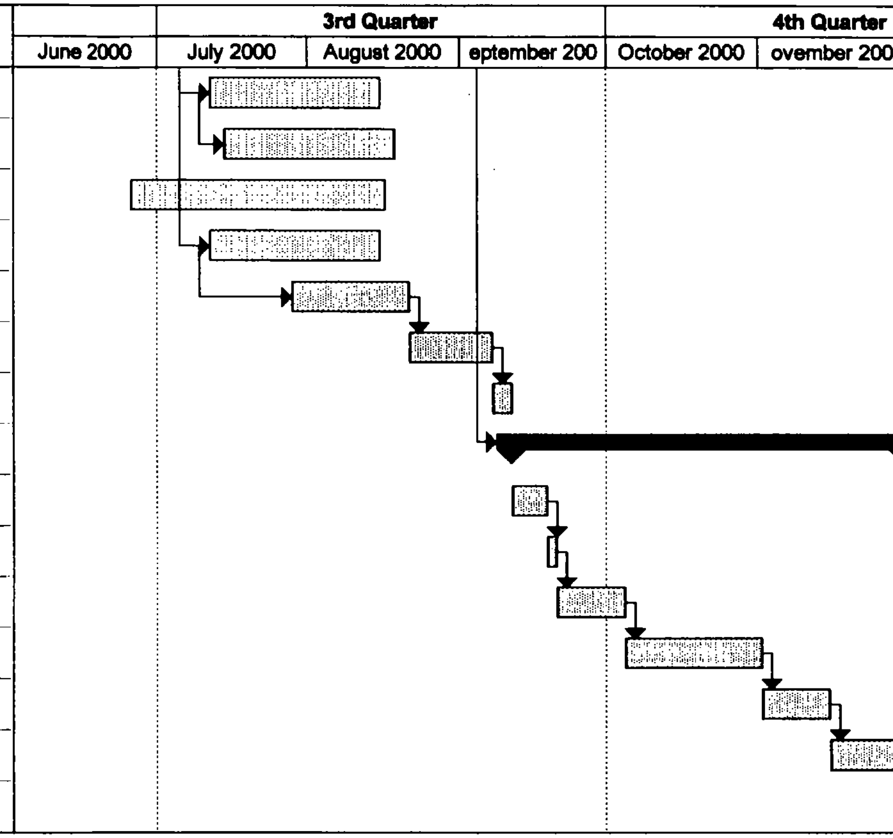


Project: Libby Removal Schedule
Date: 05/18/00

Task
Critical Task
Progress
Milestone
Summary

LIBBY ASBESTOS PROJECT
SCREENING FACILITY (OPERABLE UNIT 02) REMOVAL ACTION

ID	Task Name	Duration	Start	Finish
22	Waste Loading and Transportation	30d	07/12/00	08/15/00
23	Waste Disposal & Recycling	30d	07/15/00	08/18/00
24	Import Clean Backfill Material	45d	06/26/00	08/16/00
25	Backfill & Compact Imported Materials	30d	07/12/00	08/15/00
26	Site Grading	20d	07/29/00	08/21/00
27	Site Restoration	15d	08/22/00	09/07/00
28	Demobilization	3d	09/08/00	09/11/00
29	**Post Construction Phase - Screening Facility**	**58d**	**09/12/00**	**11/30/00**
30	Conduct Final Inspections with VOLPE and EPA	5d	09/12/00	09/18/00
31	Submit Notice of Completion	2d	09/19/00	09/20/00
32	Submit Project Accruals and FINAL CQC Submittals	10d	09/21/00	10/04/00
33	Submit DRAFT Close-out Report	20d	10/05/00	11/01/00
34	VOLPE Review of Close-out Report	10d	11/02/00	11/15/00
35	Incorportate Comments	10d	11/16/00	11/29/00
36	Final Report	1d	11/30/00	11/30/00



Project: Libby Removal Schedule
Date: 05/18/00

Task | Progress | Summary
Critical Task | Milestone

TARGET SHEET

EPA REGION VIII

SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOCUMENT NUMBER: 2000505

SITE NAME: LIBBY ASBESTOS

DOCUMENT DATE: 05/17/2000

DOCUMENT NOT SCANNED

Due to one of the following reasons:

- ☑ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
- ☐ OVERSIZED
- ☐ AUDIO/VISUAL
- ☐ PERMANENTLY BOUND DOCUMENTS
- ☐ POOR LEGIBILITY
- ☐ OTHER
- ☐ NOT AVAILABLE
- ☐ TYPES OF DOCUMENTS NOT TO BE SCANNED (Data Packages, Data Validation, Sampling Data, CBI, Chain of Custody)

DOCUMENT DESCRIPTION:

APPENDIX A - Photographs of the Former Screening Plant (11 Pictures)

Contact the Superfund Records Center to view available document.
(303) 312-6473

Appendix B

Text Portion of Sampling and Quality Assurance Project Plan Developed by EPA

SAMPLING AND QUALITY ASSURANCE PROJECT PLAN
REVISION 1

FOR

Libby, Montana

Environmental Monitoring for Asbestos

Baseline Monitoring for Source Area and Residential Exposure to Tremolite-Actinolite Asbestos Fibers

On Scene Coordinator:

Paul Peronard , OSC
8EPR-PAER

Science Support Coordinator:

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8EPR-PS

DOCUMENT REVISION LOG

Revision	Date	Major Changes
0	12/6/99	--
1	1/4/00	a. Revised text to clarify study design and DQOs b. Added SOP for surface water to allow collection and evaluation of surface water as a transport medium c. Added alternative SOP for asbestos analysis in soil that may have higher sensitivity than other methods. d. Added figures to help illustrate key steps from sample collection to analysis e. Added final SOPs as appendices to the revision.

Table of Contents

A. PROJECT TASK ORGANIZATION

A3 PROJECT MANAGEMENT

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USEPA Region 8

A4 PROBLEM DEFINITION and BACKGROUND

<u>Problem:</u> This sampling plan has been developed in response to requests from the State of Montana, Lincoln County Health Board (meeting minutes, 11/23/99), and City officials of Libby, MT, to address questions and concerns raised by citizens of Libby regarding possible ongoing exposures to asbestos fibers as a result of historical mining, processing and exportation of asbestos-containing vermiculite. Over 60 years of mining, milling, packaging and shipping of vermiculite at the mine and associated properties resulted in the environmental release of asbestos fibers during mining operations (McDonald et al., 1986; Amandus et al., 1987; Amandus and Wheeler; 1987; Amandus et al., 1978). Since closure of the mine in 1990, it is expected that production-related emissions have been greatly reduced or eliminated.

However, there are presently insufficient data to conclude that current exposures to residents in Libby and the surrounding area and occasional recreational visitors to the former mining areas are negligible. ***The purpose of this sampling effort is to acquire information suitable for supporting an exposure and risk assessment for current environmental conditions in Libby.***

Background: Asbestos is a generic term for a group of six naturally-occurring, fibrous silicate minerals that have been widely used in commercial products. Asbestos minerals fall into two groups or classes: serpentine asbestos and amphibole asbestos. Serpentine asbestos, which includes the mineral chrysotile, a magnesium silicate mineral, possesses relatively long and flexible crystalline fibers that are capable of being woven. Amphibole asbestos, which includes the minerals amosite, crocidolite, tremolite, anthophyllite, and actinolite, form crystalline fibers that are substantially more brittle than serpentine asbestos.

Asbestos is of potential health concern because chronic inhalation exposure to excessive levels of asbestos fibers suspended in air can result in lung disease such as asbestosis, mesothelioma, and lung cancer. Figure 1 presents a preliminary Site Conceptual Model which identifies exposure pathways by which asbestos fibers from mining-related sources might become entrained in air in Libby, leading to inhalation exposures of residents or workers. The site conceptual model will be refined as site data are acquired and an improved understanding of actual transport and exposure pathways is achieved.

Approach: This sampling plan describes the efforts planned by EPA to monitor and characterize asbestos-containing materials in and about the vicinity of Libby. The plan will be composed of two phases:

Phase 1: This is a rapid pilot-scale investigation that has two main objectives:

a) Obtain information on airborne asbestos levels in Libby in order to judge whether a time-critical intervention is needed to protect public health.

b) Obtain data on asbestos levels in potential source materials, and identify the most appropriate analytical methods to screen and quantify asbestos in source materials.

Phase 2: This will consist of a systematic evaluation of asbestos levels in air in Libby and in appropriate background locations, along with a systematic investigation to identify the actual or potential source(s) and release mechanism(s) of asbestos in Libby and the surrounding area. The implementation, pace and scope of Phase 2 and the methods used to collect and analyze samples in Phase 2 will be determined in large part by the results of the Phase 1 pilot study.

Interpretation. Analyses of asbestos fibers in air and other site media will determine the potential (or lack of potential) for human inhalation exposure under **present** conditions. The environmental fate and transport of asbestos fibers may be such that present measurement conditions (e.g. weather) and/or measurement techniques interfere with the ability to identify and/or quantify asbestos fibers in relevant exposure media (soil, dust, air, or water). Thus, while conclusions drawn from the implementation of this study are applicable to the present conditions at the site, they do not necessarily reflect conditions which may develop in the future.

A5 PROJECT TASK DESCRIPTION

To the extent possible, sampling will be conducted such that data will be meaningful for human exposure and risk assessment. Because the chief exposure pathway is air, emphasis will be placed on collection of air samples. In addition, to help identify potential sources and transport pathways for asbestos, samples of various bulk materials (mine waste, soil, dust, water, sediment) will also be collected in residential and non-residential areas.

Phase 1

Basic tasks needed to complete Phase 1 are listed below:

1. Collect samples of air, soil, dust, water, and insulation from selected locations in and around town, including a number of residential and/or commercial locations, as well as suspected source areas such as historical mining/processing/loading facilities.

2. Perform asbestos analyses on all air samples and a selected set of the dust, soil, insulation and water samples (those judged to be most likely to have either "high" or "low" concentrations) in order to obtain preliminary information on asbestos levels in air and other media, and to identify the optimum conditions for collection and analysis of bulk media.

At this time, the proposed sampling for Phase 1 consists of collection of environmental media from approximately 30 residences and 3 potential source areas. Residential sample locations will be selected from residences volunteering for multimedia sampling. In addition to the collection of samples within the residential area, samples may also be collected in commercial warehouses, agricultural buildings, or businesses in Libby, as needed to support the objectives of the On Scene Coordinator. Potential source area samples will be collected along the mine road (Rainy Creek Road) and at the Former Vermiculite Loading facility near the intersection of Rainy Creek Road and Highway 37.

Media samples will be collected according to Standard Operating Procedures provided by CDM, Inc. or as provided in the attachments to this Sampling and Quality Assurance Plan.

Phase 2

The purpose of Phase 2 is to design and implement a systematic program of sample collection and analysis to fully characterize levels of health risk from long-term inhalation exposure to asbestos in air, and to identify any actual or potential sources and release mechanisms of asbestos. Specific tasks needed to implement Phase 2 will be selected after completion of Phase 1.

A6 QUALITY OBJECTIVES and CRITERIA for MEASUREMENT DATA

Two types of objectives are identified in this quality assurance project plan (QAPP): general objectives and data quality objectives (DQOs). General objectives are statements of practical goals that, if realized, will substantially contribute to achieving the purpose of the study. Development of DQOs is a process that is intended to ensure that task objectives are clearly defined and that data collected are appropriate and of sufficient quality to satisfy the objectives.

Phase 1 General Objective 1

Determine whether current airborne levels of asbestos in Libby are high enough to warrant a time-critical intervention.

Phase 1 General Objective 2

Obtain preliminary data on asbestos concentrations in potential source materials for air (e.g., dust, soil, mine waste), and determine the optimum conditions for sampling and quantifying asbestos levels in source materials.

Phase 2 General Objective

The general objectives for Phase 2 is to collect reliable and systematic data on asbestos levels in air and other media in Libby to allow a reliable evaluation of current human exposure and health risk from asbestos as well as an identification of sources of unacceptable levels of asbestos in air.

Data Quality Objective Process

The DQO process can be an iterative process which is designed to focus on the decisions that must be made and to help ensure that the site activities that acquire data are logical, scientifically defensible, and cost effective. The DQO process is intended to:

- Ensure that task objectives are clearly defined
- Determine anticipated uses of the data
- Determine what environmental data are necessary to meet these objectives
- Ensure that the data collected are of adequate quantity and quality for the intended use

The three stages of the DQO process are identified below and a discussion of how they have been applied in the characterization study described herein. The three stages are undertaken in an interactive and iterative manner, whereby all the DQO elements are continually reviewed and re-evaluated until there is reasonable assurance that suitable data for decision making will be attained.

- Stage I - Identify Decision Types: Stage I defines the types of decisions that will be made by identifying data uses, evaluating available data, developing a conceptual model, and specifying objectives for the project. The conceptual model facilitates identification of decisions that may be made, the end use of the data collected, and the potential deficiencies in the existing information.

- Stage II - Identify Data Uses/Needs: Stage II stipulates criteria for determining data adequacy. This stage involves specifying the quantity and quality of data necessary to meet the Stage I objectives. EPA's Data Usability for Risk Assessment Guidance (DURA) outlines general and specific recommendations for data adequacy. This includes identification of data uses and data types, and identification of data quality and quantity needs.

- Stage III - Design Data Collection Program: Stage III specifies the methods by which data of acceptable quality and quantity will be obtained to make decisions. This information is provided in the SOP.

Through utilization of the DQO process, as defined in EPA guidance (EPA540-R-93-071 and -078, Sep 1993), this QAPP will use several terms that are specifically defined to avoid confusion that might result from any misunderstanding of their use. For each of the tasks identified within this QAPP, a "Task Objective" is specifically defined. The Task Objective is a concise statement of the problem to be addressed by activities under this task. For each Task Objective, a decision (or series of decisions) is identified which addresses the problem contained in the Task Objective.

For each decision, the data necessary to make the decision are identified and described. For all analytical data, quality assurance objectives are specified that describe the minimum quality of data necessary to support the specified decision or test the hypotheses. These quality assurance objectives are specified as objectives for precision, accuracy, representativeness, comparability, and completeness. In addition, data review and validation procedures are specified in the QAPP that evaluate how well the analytical data meet these quality assurance objectives and whether or not the data are of sufficient quality for the intended usage.

The following sections apply the DQO process to the Libby Project, Stage I and Stage II. Stage III is discussed later (see Section B), but sampling and analysis methods presented in this section are considered tentative and final decisions on optimum sampling and analytical methods will be delayed until the findings of Phase 1 are available.

DQO Stage I - Identifying Decision Types

Stage I of the DQO process identifies a primary question and secondary questions that need to be resolved at the completion of the sampling and analyses program.

- PRIMARY QUESTION (Phase 1): Are current airborne levels of asbestos sufficiently high to warrant a time-critical intervention?

- SECONDARY QUESTION (Phase 1): What are the most likely sources of asbestos in air, and what are the best methods for quantifying asbestos levels in potential source materials?

DQO Stage II - Identifying Data Uses/Needs

Stage II of the DQO process also determines what type and quality of data are needed to answer the questions developed in Stage I. EPA has developed a seven-step method for developing the DQOs. This seven-step method is applied below in order to define the data requirements needed to achieve the primary and secondary objectives of the Phase 1 evaluation (and summarized in Table 1).

Primary Objective: Evaluate The Need For Time-critical Action

1. State the Problem

The problem to be addressed by this study is that citizens of Libby appear to have an increased incidence of asbestos-related disease, but there are no data to determine if this disease is attributable solely to historic exposures, or whether current exposures are of continuing health concern.

2. Identify the Decision

The first decision to be made is whether or not time-critical intervention is needed to protect public health. If current exposures are not high enough to warrant time-critical intervention, the next decision is whether or not non-time-critical remedial action is needed.

3. Identify Inputs to the Decision

Decisions on the need for time-critical intervention or non-time-critical remediation will be based on estimated risk of lung disease in current residents and workers in Libby. Two types of lung disease are of concern: asbestosis (a non-cancer effect) and lung cancer and mesothelioma (cancer effects). Limited data suggest that chronic exposures to chrysotile fiber levels of 5-20 f/mL can cause asbestotic changes (ATSDR 1999), but data are not sufficient to derive a reliable chronic MRL or RfC for asbestosis. However, methods have been established for estimating the excess risk of lung cancer and/or mesothelioma, and it is considered likely that exposure levels that protect against unacceptable risk of lung cancer/mesothelioma (in the range of 0.1 to 0.0001 f/mL; see below) will also protect against unacceptable risk of asbestosis.

The basic equation used to estimate cancer risk is:

Risk = Concentration (f/mL) * Unit Risk (risk per f/mL)

Thus, the data needs are an **estimate of airborne asbestos concentration** and an **estimate of cancer risk per unit concentration**.

Measurement of Asbestos Concentration in Air

There are a number of techniques for measuring asbestos fibers in air, all of which are based on visual identification of structures as asbestos fibers. Most historical human health data and many regulatory limits for asbestos exposure in air are based upon asbestos fiber concentrations measured using phase contrast microscopy (PCM) (see Table 2). In this method, **fiber material** is defined as having a length >5 microns and an aspect ratio (length to diameter ratio) of three or more. Results are generally reported as fibers per milliliter of air (f/mL).

More recently, a number of other methods have been developed for quantitative or qualitative measurement of asbestos fibers in air, including transmission electron microscopy (TEM), and x-ray diffraction (XRD). These methods are generally more sensitive than PCM, and also allow visualization and quantification of asbestos fibers that are thinner than those visible under PCM. This is important because it is likely that the toxicity of long thin fibers is greater than that of shorter thicker fibers (Berman et al., 1995). Based on this, **asbestos fibers in air will be quantified by TEM.** Detailed rules for identifying asbestos fibers of biological concern by TEM are provided in ISO method 10312. This method is an international standard procedure that is recommended for quantifying asbestos fibers that are believed to be the chief source of human health concern (Berman and Crump 1999).

Unit Risk for Asbestos in Air

It is mandatory that the unit risk value used to calculate cancer risk be based on the same type of asbestos measurement technique as used to quantify asbestos concentration in air. That is, it is not correct to estimate risk by multiplying a concentration based on TEM fibers per mL by a unit risk based on PCM fibers per mL. Thus, risk-based values shown in Table 2 cannot be used to interpret measurements based on TEM. EPA has developed a model for predicting risk from mesothelioma and lung cancer from TEM-based measurements of asbestos in air (USEPA 1986), and this method has been revised and improved by Berman and Crump (1999) to incorporate the influence of fiber length. The risk factors for the modified mesothelioma and lung cancer model are summarized in Table 3. Note that the risk factor depends not only on the number of TEM fibers greater than 5 um in length, but also on the fraction of all fibers that are longer than 10 um.

The toxicity factors shown in Table 3 are based on the best data currently available, but it is important to recognize that these toxicity factors are uncertain. This is because the values are derived from studies in which important details of exposure (level, duration, fiber size distribution, etc.) are not always known. In particular, the importance of fiber size (length, thickness) and fiber type (tremolite, chrysotile, etc.) on toxicity is difficult to quantify and remains a source of discussion.

4. Define the Study Boundaries

Spatial Bounds

The spatial bounds to be investigated in this project include the community of Libby, and areas associated with former mining activities near the town. Appropriate background areas may be selected for comparative evaluation.

Temporal Bounds

Asbestos fibers enter air mainly as a result of resuspension due to mechanical disturbance or wind erosion. Because mechanical and wind forces may vary substantially over time, asbestos levels in air are also expected to vary substantially over time. Thus, estimates of long term average concentrations are inherently preferable to measurements based on grab samples. Therefore, multiple samples of air will be collected over time at locations of interest. It is likely the highest levels will tend to occur in summer, when source areas tend to be dry and wind and mechanical forces result in significant dust resuspension.

5. Develop a Decision Rule

EPA must identify an actual or potential threat to human health or the environment in order to initiate a time-critical intervention at a site. Based on current EPA guidelines, a lifetime excess cancer risk of 1E-04 is considered to be at the upper end of the acceptable risk range for chronic (lifetime) exposure. Based on this, this Phase 1 study will use an excess cancer risk of about 1E-03 as the appropriate boundary for decision-making. That is, if asbestos levels in air correspond to an estimated cancer risk of about 1E-03 or higher, time critical actions to identify sources and find appropriate and effective interventions will be considered. If estimated cancer risks from asbestos in Phase 1 air samples do not exceed a level of about 1E-03, then further studies may be pursued to determine if risk levels might exceed 1E-03 at other times or in other places, or if risks might exceed an acceptable chronic risk level (e.g., 1E-04).

6. Specify Limits on Decision Errors

The null hypothesis that will be tested in Phase 1 is that indoor air levels in Libby are sufficiently high to warrant time-critical intervention. Two types of decision error are possible when making this decision:

Type I Error: Rejecting the null hypothesis when it really is true. That is, the site is declared to be below a risk level of 1E-03 when it is really above this level.

Type II Error: Accepting the null hypothesis when it actually is false. That is, the site is declared to be of time-critical concern when it actually is not.

The limits on these two types of errors are risk management judgements. In order to minimize the chances of a Type 1 error (a "false negative"), the decision will be based on the highest concentration of asbestos fibers detected in any currently-occupied residential or occupational building evaluated in the Phase 1 investigation. If one or more samples exceeds the 1E-03 risk level, time critical action may be needed. However, additional samples may be collected to confirm the original measurement and to refine the risk estimate. Because of the time variability in asbestos levels in air, final decisions may be delayed until additional data have been collected, including data in the summer when airborne resuspension and transport of asbestos fibers in outdoor air is considered to be more likely than in winter.

7. Optimize the Design for Obtaining Results

Additional indoor and/or outdoor air samples may be collected and incorporated into either Phase 1 and/or Phase 2 as data become available on actual airborne exposure and risk levels.

Secondary Objective: Preliminary Investigation of Source Materials

Table 4 provides a summary of the seven-step DQO process for achieving the secondary objective. The following text describes each of the DQO steps in detail.

1. State the Problem

The problem to be addressed by this portion of the study is that most methods currently available for measuring asbestos in solid materials (e.g., soil, dust, bulk insulation, mine waste, etc.) are relatively insensitive, and it is not known whether impacts of historic or ongoing asbestos releases on these media can be detected by these techniques.

2. Identify the Decision

The decision to be made is whether analysis of potential source materials and/or transport media in and about the mine (e.g., mine waste, surface water) and in and about the community of Libby (e.g., yard soil, house dust, garden soil) can be reliably quantified using available techniques. If so, then source areas judged to be of potential concern may be removed at the discretion of the OSC. Alternatively, additional sampling and analysis of potential source material may be pursed as needed to identify impacted areas and to focus on sources of unacceptable asbestos levels in air.

3. Identify Inputs to the Decision

Asbestos Measurements in Environmental Media

Inputs to the decision will be the results of asbestos analyses of each medium using the best available technique(s), as follows:

Medium	Proposed Method	
	Sample Preparation	Sample Analysis
Yard soil Garden soil Road soil Mine waste Bulk insulation	Collect bulk sample, place on slide	PLM of bulk material
	Collect bulk sample, dry	Visible reflective infrared spectroscopy
	Separate respirable dust fraction using Superfund method, collect dust on filter, collapse filter, prepare TEM grids	TEM of respirable dust
Indoor Dust	Microvacuum into cassette, suspend dust in water/alcohol, collect on filter, dry ash, prepare TEM grids	TEM
Surface Water	Collect bulk sample, filter, collapse filter, prepare TEM grids	TEM

These methods have been selected because they are judged to be the most likely to yield results that will allow qualitative or quantitative evaluation of asbestos levels in environmental media. Note that several alternative methods are identified for soil and related bulk materials. At present, it is not known which of these will be the most appropriate. It is envisioned that all samples will be screened using visible infrared spectroscopy, since this method is very fast and inexpensive. If successful, the results of this method can be used to rank-order samples into "high", "medium" and "low" concentration ranges. For quantitative assessment, it is envisioned that all samples will be analyzed by PLM, since this method is fast and relatively less expensive than the Superfund TEM method. This evaluation will begin with samples that are known or suspected to be high in asbestos concentration, based either on the infrared results and/or field observations such as the presence of visible levels of vermiculite, proximity to known sources or waste materials, etc. The analyses will continue through the samples to those that are known or suspected to contain "low" levels. When asbestos fiber concentrations are consistently below the detection limit, further analyses by PLM may be discontinued. After the results of the infrared and the PLM analyses are available, a set of samples will be selected for analysis by the Superfund method. This method is expected to be the most sensitive, because it includes a preliminary separation of respirable asbestos fibers from the bulk material, and because quantification is by TEM rather than PLM. However, the method is not yet in wide use, and is associated with a relatively high cost and slow turnaround time. It is for this reason that only about 15-21 samples will be evaluated by this approach. This set will be composed of approximately 5-7 in each of three categories: "high", "medium", and "low". Comparison of results across these three methods will allow an evaluation of which method(s) is (are) most appropriate for on-going evaluation of soils and related materials at the site.

For the other media (dust, surface water), all samples collected will be analyzed by the analytical methods indicated above. A comparison of results across samples will be used to determine whether the method is likely to be reliable and useful for further evaluation of site samples.

Community Interview

EPA will administer a community interview to numerous Libby residents including residents of each household sampled. These interviews will help gauge community members' level awareness about asbestos, their health concerns about asbestos, their knowledge about activities that may results in asbestos exposure, as well as possible sources of asbestos-bearing material. This information may help explain observed asbestos levels in samples from the home. A copy of the interview questionnaire is provided in Section E (Appendices).

4. Define the Study Boundaries

Spatial Bounds

The spatial bounds to be investigated in this project include the community of Libby, and areas associated with former mining activities near the town.

Temporal Bounds

Asbestos levels in source or transport material are expected to be relatively stable. Thus, the time when source area samples are collected is not judged to be critical.

5. Develop a Decision Rule

If no observable difference in asbestos concentration can be detected between the two classes of samples ("high" vs "low"), it will be concluded that a) either the medium is not impacted, or b) the measurement technique is not sufficiently sensitive. If a difference can be detected, it will be concluded that there is an impact to that medium, along with an actual or potential release to the environment, and that the current method can be used to further investigate and quantify that release.

6. Specify Limits on Decision Errors

Because the decision to be made is mainly with regard to method adequacy, no quantitative rules are needed to define decision errors.

7. Optimize the Design for Obtaining Results

Additional source area samples may be collected and incorporated into either Phase 1 and/or Phase 2 as data become available on the ability of current methods to detect and quantify asbestos fibers in each medium.

PARCC Requirements

Within this QAPP, quantitative and qualitative limits are defined for precision, accuracy, representativeness, comparability and analytical completeness. Reporting limits for asbestos fibers are set by the analytical laboratory based on environmental matrix, historical data, and comparison to EPA limits for CLP and other methods. Quantitative limits are also defined by microscopy (light microscopy or TEM) for method detection limits, and for method reporting limits or method quantitation limits. The QA procedures outlined in this section are intended to ensure data quality and to administer corrective actions with the goal of producing data that satisfy the following requirements. General guidelines, policies, and procedures to achieve these objectives are presented below. Where additional, detailed, procedures are required to attain QA objectives and to describe specific methods, these are provided in the SOPs (see attached). The following PARCC requirements apply to more standard chemical analytical analyses, and partially to asbestos analyses (e.g., identifying physico-chemical make-up of specific fibers)

Precision: Precision is defined as the agreement between a set of replicate measurements without assumption or knowledge of the true value. It is a measure of agreement among individual measurements of the same property under prescribed similar conditions. Agreement is expressed as either the relative percent difference (RPD) for duplicate measurements or the range and standard deviation for larger numbers of replicates. The RPD will be reported on required 5% laboratory duplicates.

Accuracy: Accuracy is a measure of the closeness of individual measurements to the "true" value. Accuracy usually is expressed as a percentage of that value. For a variety of analytical procedures, standard reference materials traceable to or available from National Institute of Standards and Technology (NIST, formerly National Bureau of Standards) or other sources can be used to determine accuracy of measurements. Accuracy will be measured as the percent recovery (%R) of an analyte in a reference standard or spiked samples (>3 at each selected concentration range) that span the limit of linearity for the method.

Ideally, precision and accuracy estimates should represent the entire measurement process, including sampling, analysis, calibration, and other components. From a practical perspective, these estimates usually represent only a portion of the measurement process that occurs in the analytical lab.

<u>Representativeness</u>: Representativeness is the degree to which data accurately and precisely represent characteristics of a population, parameter variations at a sampling point, or an environmental condition. For this QAPP, data and samples representative of chemical and biological exposures in the study and reference areas are to be collected from randomly chosen residences.

<u>Comparability</u>: Data are comparable if site considerations, collection techniques, and measurement procedures, methods, and reporting are equivalent for the samples within a sample set. A qualitative assessment of data comparability will be made of applicable data sets. These criteria allow comparison of data from different sources. Comparable data will be obtained by specifying standard units for physical measurements and standard procedures for sample collection, processing, and analysis. Please see the attached SOPs for sampling and analysis procedures.

<u>Completeness</u>: Data are considered complete when a prescribed percentage of the total intended measurements and samples are obtained. Analytical completeness is defined as the percentage of valid analytical results requested, and >90% of analyzed samples should have results reported. For this sampling program, a minimum of 80 percent of the planned collection of individual samples for quantification and a minimum of 30 percent of related parameters (e.g., physical measurements, fiber type, etc.) must be obtained to achieve a satisfactory level of data completeness.

<u>Method Detection Limits (applicable to chemical analyses only)</u>: Method detection limits (MDLs) are minimum values that can be reliably measured to identify the analyte as being present in the matrix, versus method quantitation limits are the minimum values that can be quantitated with reasonable scientific confidence. The method will also have a maximum linear value in most situations, and analyses should occur within this limit of linearity range. See applicable operating procedures for details.

Table 1. DQOs for Primary Objective: Evaluate the Need for Time-Critical Action

DQO Step	Description
1. Define the problem	The citizens of Libby appear to have an increased incidence of asbestos-related disease, but there are no data to determine if this disease is attributable solely to historic exposures, or whether current exposures are of continuing health concern.
2. Identify the decision	Is time-critical action needed to protect public health? If yes, identify appropriate action and intervene as necessary If no, determine whether or not non-time-critical remediation is necessary
3. Identify inputs to decision	Level of concern for human health (lifetime excess cancer risk of 1E-03) Estimate of airborne asbestos concentration, and cancer risk per unit concentration.
4. Define study boundaries	*Spatial bounds*: Community of Libby, including former mining, milling and processing areas and areas potentially impacted as defined by meteorological conditions. If necessary, appropriate background areas are also included (precise locations to be defined). *Temporal bounds*: multiple air samples will be collected in areas associated with former mining activities near the town seasonally throughout the year
5. Define decision rule	If asbestos levels in indoor air $\geq$ 1E-03 risk level, consider the need for time-critical intervention. If asbestos levels in indoor air < 1E-03 risk level, time-critical intervention may not be necessary. However, additional studies may be needed to determine if non-time-critical remediation is necessary, or if levels might exceed 1E-03 risk levels under different conditions (e.g., seasonal variation)
6. Specify limits on decision errors	Risk management decisions will be based on the highest airborne asbestos concentration found in any residential or occupational building.
7. Optimize the design	Incorporate new information as data become available on actual airborne exposure and risk levels.

Table 2: Summary of Available PCM-Based Exposure Levels for Asbestos

Agency	Description	Nominal Value	Reference
ACGIH	TLV-TWA	0.1 f/cc	ACGIH, 1998
NIOSH	REL 100 minute TWA in a 400L sample (all forms)	0.1 f/cc	NIOSH 1999
OSHA	PEL (TWA) all forms	0.1 f/cc	OSHA 1998 29 CFR 1919.1001
OSHA	PEL (ceiling) 30 minute average - all forms	1.0 f/cc	OSHA 1998 29 CFR 1926.1101
EPA (IRIS)	Inhalation unit risk - all forms	0.23 per (f/mL)	IRIS 1999
EPA (OW)	MCL (f>10 um in length) all forms	7 MFL[a]	EPA 1998

[a] MFL = million fibers per liter

TABLE 3. Unit Risk for Inhalation of Asbestos

Population	Percentage of Fibers Greater than 10 um in Length										
	0.50%	1%	2%	4%	6%	10%	15%	20%	30%	40%	50%
Male Nonsmoker											
Lung Cancer	1.0E-02	1.6E-02	3.0E-02	5.4E-02	8.0E-02	1.3E-01	1.9E-01	2.6E-01	3.8E-01	5.0E-01	6.4E-01
Mesotheliomas	1.1E-01	1.9E-01	3.2E-01	6.2E-01	9.0E-01	1.5E+00	2.2E+00	2.9E+00	4.3E+00	5.8E+00	7.2E+00
Total	1.2E-01	2.0E-01	3.5E-01	6.7E-01	9.8E-01	1.6E+00	2.4E+00	3.2E+00	4.7E+00	6.3E+00	7.8E+00
Female Nonsmoker											
Lung Cancer	7.6E-03	1.2E-02	2.2E-02	4.0E-02	6.0E-02	9.6E-02	1.4E-01	1.9E-01	2.8E-01	3.8E-01	4.8E-01
Mesotheliomas	1.3E-01	2.0E-01	3.6E-01	6.8E-01	1.0E+00	1.7E+00	2.5E+00	3.3E+00	4.9E+00	6.5E+00	8.1E+00
Total	1.4E-01	2.1E-01	3.8E-01	7.2E-01	1.1E+00	1.8E+00	2.6E+00	3.5E+00	5.1E+00	6.8E+00	8.5E+00
Mean Total for Nonsmokers	2.6E-01	4.1E-01	7.3E-01	1.4E+00	2.0E+00	3.4E+00	5.0E+00	6.6E+00	9.8E+00	1.3E+01	1.6E+01
Male Smoker											
Lung Cancer	9.4E-02	1.5E-01	2.6E-01	5.0E-01	7.4E-01	1.2E+00	1.8E+00	2.4E+00	3.5E+00	4.7E+00	5.9E+00
Mesotheliomas	7.6E-02	1.2E-01	2.2E-01	4.2E-01	6.0E-01	9.8E-01	1.5E+00	1.9E+00	2.9E+00	3.8E+00	4.8E+00
Total	1.7E-01	2.8E-01	4.8E-01	9.2E-01	1.3E+00	2.2E+00	3.2E+00	4.3E+00	6.4E+00	8.5E+00	1.1E+01
Female Smoker											
Lung Cancer	6.4E-02	1.0E-01	1.8E-01	3.4E-01	5.0E-01	8.2E-01	1.2E+00	1.6E+00	2.4E+00	3.2E+00	4.0E+00
Mesotheliomas	1.1E-01	1.9E-01	3.2E-01	6.2E-01	9.0E-01	1.5E+00	2.2E+00	2.9E+00	4.3E+00	5.8E+00	7.2E+00
Total	1.8E-01	2.9E-01	5.0E-01	9.6E-01	1.4E+00	2.3E+00	3.4E+00	4.5E+00	6.7E+00	9.0E+00	1.1E+01
Mean Total for Smokers	1.7E-01	2.8E-01	4.9E-01	9.4E-01	1.4E+00	2.2E+00	3.3E+00	4.4E+00	6.6E+00	8.8E+00	1.1E+01

Source: Berman and Crump (1999)